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CONTAMINATION OF POPULATED ESTUARIES AND ADJACENT COASTAL OCEAN--A GLOBAL REVIEW

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ABSTRACT. A comparison of the contamination of coastal marine waters in the New York Bight with that of other populated coastal and estuarine marine areas demonstrates that the New York Bight does not appear to be more polluted, nor suffer from pollution impacts to any greater degree, than many other studied regions. Toxic contaminant levels, including concentrations of heavy metals and PCBs in sediments and water, found in the New York Bight are similar to those in many of the world's heavily populated coastal areas.

Based on population densities, the degree of industrialization, discharge volumes, and coastal hydrography, the New York Bight is not among the most pollution-susceptible regions of the world ocean (e.g., Saronikos Gulf, Guanabara Bay, Brazil, and New York, Singapore, and Hong Kong harbors), but, instead, is comparable to the large, but poorly flushed, semi-enclosed seas (e.g., the Baltic, Mediter ranean, Irish, North, and Seto Inland seas). The total annual inputs of contaminants to the New York Bight are within the range of annual mass contaminant loadings to these and other comparable regions. While contaminant inputs may be similar, differences in hydrographic characteristics of these regions strongly influence the pollutant distributions in the ocean environment. For example, the Rhine-Meuse and Hudson-Raritan contribute similar quantities of contaminants to the ocean, but the much stronger tidal currents and dispersive forces of the Rhine-Meuse discharge area effectively reduce the ambient concentrations of contaminants. In contrast, contaminant inputs to the Saronikos Gulf in the Mediterranean are much smaller than those to the New York Bight, but contaminant concentrations are higher than the highest found in the New York Bight due to the restricted circulation of the Gulf.

Biotic concentrations of heavy metals and organic contaminants in the oceans, including New York Bight, do not appear to pose any substantive risk to human health, since they are rarely found to exceed established regulatory levels for these contaminants. Ex

ceptions occur in localized areas, which receive large inputs of industrial and sewage discharges, such as such as portions of the Hudson-Raritan estuary.

Observed contaminant concentrations are universally below lethal toxicity levels for marine organisms except in extremely limited areas adjacent to contaminant discharges or ocean outfalls, or for short periods of time within an ocean dumping discharge plume. Sublethal effects on marine organisms caused directly by toxic chemical contaminants have rarely been demonstrated in the oceans themselves. Serious effects of pollutants on the world's oceans appear to be highly isolated and localized, and marine systems have demonstrated a high degree of recuperative ability when inputs of contaminants to a degraded area are reduced. Most ecological change, including change in species compositions of finfish and benthic fauna, is more likely caused by natural climatic variations, anthropogenic inputs of nontoxic organics or nutrients, and over fishing. Anoxic events observed throughout the world are natural phenomena which in some areas, including the New York Bight, may be significantly exacerbated by nutrient-induced eutrophication, but not by input of sewage sludge.

Under appropriate conditions of introduction and dilution, the oceans are capable of accommodating large anthropogenic inputs with no significant effects on biota and human health, and without causing oxygen depletion. Southern California coastal waters have dispersive conditions which are perhaps ideal; however, contaminant concentrations immediately surrounding a Southern California sewage sludge outfall exceed those found in the New York Bight in the vicinity of a sewage sludge dumpsite. It is apparent that the method of introducing waste material to the ocean critically controls contaminant distributions in the discharge environment.

The New York Bight, including its apex region, is a moderately effective dispersive ecosystem, and contaminant concentrations are not extreme compared to other populated coastal areas of the world. The New York Bight appears to have suffered no irreversible ecological damage. However, more frequent anoxic events are likely if nutrient inputs to the sea should continue to increase.